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ELECTRONICS AND ELECTRICAL ENGINEERING

No. 106

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USSR REPORT

ELECTRONICS AND ELECTRICAL ENGINEERING

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UDC: 621.314:621.396.674:621.382

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Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 3, Mar 83
(manuscript received 10 Aug 81) pp 613-615

YEGOROV, A. N., KOLMYKOV, A. I., LOKTIONOV, A. Ye. and RUVINSKIY, V. I.

[Abstract] A rectenna array receives incident microwave radiation and rectifies it in each element independently. The received power is then added as dc electricity. This report presents a method for and the results of a comparative experimental study of the effectiveness of rectenna elements, i.e., dipoles with a rectifier consisting of a single semiconductor diode and dipoles with a double half-period bridge circuit consisting of four diodes. The comparative study indicates that a dipole with a single diode rectifier is almost equal in effectiveness to a dipole with a 4-diode bridge rectifier. Figures 4; references: 1 Russian.
[203-6508]

UDC: 621.317

PREDICTING MEAN SIGNAL LEVEL IN LONG RANGE TROPOSPHERIC RADIO COMMUNICATIONS CHANNEL

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received after completion 8 May 82) pp 82-84

GRIGOR'YEV, V. G. and KON'KOV, V. A.

[Abstract] A signal passing through a tropospheric scatter radio channel is subject to multiplicative fading and its level can be represented as the product of rapidly and slowly changing components. The slowly changing components with correlation intervals of some tens of minutes determines the mean received signal level. An algorithm is suggested for determining the overall signal level based on the statistical characteristics of the slowly changing component of fluctuation. The algorithm is distinguished by its simplicity and allows timely prediction of the mean signal level in such a channel. References 3: 2 Russian, 1 Western in translation.
[208-6508]

UDC: 621.396.667.49

INFLUENCE OF RANDOM PHASE ERRORS ON LOSSES AND INTERNAL NOISE IN PHASED ANTENNA ARRAYS

Moscow RADIOTEKHNIKA in Russian No 3, May 83 (manuscript received 15 May 82) pp 17-22

BABENKO, A. I., ZAYTSEV, E. F. and NUZHIN, V. K.

[Abstract] The results are presented of theoretical and experimental studies of the influence of random phase errors on losses and the internal noise caused by them in passive scanning phased antenna arrays, with the interaction of elements taken into account. It is shown that, depending on the degree and nature of interaction, the same phase errors cause significantly different changes in antenna array losses and sensitivity. Experiments confirm that when there is no mutual coupling, phase errors do not influence antenna array losses; when there is interaction, even with matched elements the errors result in increased losses. The results obtained can be directly used in analyzing the characteristics not only of purely passive but also of active phased antenna arrays in which one active element is connected to a group of radiator elements. Figures 4; references 16: 13 Russian, 3 Western (1 in translation). [208-6508]

UDC: 621.315/61:535

SOUND EXCITATION AND DEVELOPMENT OF ADDITIONAL LOSSES IN SINGLE MODE FIBER LIGHT GUIDE TRANSMITTING AMPLITUDE MODULATED OPTICAL WAVES

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received 11 Dec 82) pp 84-86

BAZAROV, Ye. N. and POLUKHIN, A. T.

[Abstract] Very small diameter fiber light guides exhibit significant electrostriction effects even at very low signal levels because of the high electric field intensity produced. The influence of electrostriction effects if greater, the longer the light guide. The sound generated by these effects is a serious negative factor causing noise on optical signals. A theoretical analysis is presented of some aspects of the problem. It is assumed that an optical wave with time-modulated amplitude enters a fiber optical light guide, with the characteristic modulation frequency much less than the optical frequency, lying within the audio frequency range. Equations are presented for the sound pressure generated, electric field distribution in the optical bundle and velocity potential. The authors thank Ye. I. Sverchkov and G. I. Telegin for helpful discussion of the work. References 2: 1 Russian, 1 Western. [208-6508]

UDC: 621.391:519.2

INFLUENCE OF A PRIORI UNCERTAINTY ON SIGNAL DIFFERENTIATION ERROR

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 3, Mar 83 (manuscript received 22 Jun 81) pp 600-603

STERLIN, G. Kh. and CHERDYNTSEV, V. A.

[Abstract] An attempt is made at quantitative estimation of the influence of types of actual and hypothetical distributions on the accuracy of differentiation of a certain unknown random quantity with a priori uncertainty of the actual distribution of the quantity. Results are obtained for the case of differentiation of m orthogonal signals with identical energies received against a background of additive white noise. The problem is stated as one of

determining the variation in error probability as a function of the types of actual and hypothetical a priori distributions. The results confirm the hypothesis that the least preferable a priori distribution is that with maximum entropy, and lead to a more general hypothesis: that the accuracy of differentiation decreases with increasing antropy of the actual distribution and distance between actual and hypothetical distributions. References: 4 Russian.
[203-6508]

UDC: 621.391:537.6

NOISE TOLERANCE OF SPIN SIGNAL PROCESSING DEVICE IN THREE PULSE MODE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 3, Mar 83 (manuscript received 11 May 81) pp 598-600

LEVIN, Yu. K.

[Abstract] One distinguishing feature of a spin device in the three pulse mode is incomplete phasing of the magnetic moments of nuclei in the formation of a spin echo. The noise tolerance of a spin device in the three pulse mode is calculated with the assumption that the incident signals are small. The noise tolerance is estimated as the ratio of peak spin echo power to mean noise power. References 5: 4 Russian, 1 Western.
[203-6508]

UDC: 621.396

RESULTS OF MODELING OF ADAPTIVE NONPARAMETRIC LINEAR POLARIZATION-KEYED SIGNAL CLASSIFIER

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received after completion 5 Jun 82) pp 73-75

POPOVSKIY, V. V., DMITRIYEV, V. I., DAVYDENKO, V. V. and GLUSHANKOV, Ye. I.

[Abstract] A communications line using polarization keying of signals is studied. The task is to use the control device to minimize crosstalk between the two signals in the communications channel. The use of parametric adaptive procedures in order to recover the orthogonality of the signals is ineffective because of the high a priori uncertainty. The weighted coefficients vector is generated by means of a classification sample and the adaptation factor is determined with the use of an expression given in the text. Analysis of a large number of learning samples shows that the algorithm suggested rather rapidly converges on the minimum error probability, after 100 to 150 steps with 0.9 polarization, and 200 steps with 0.5 polarization. The results of modeling indicate the possibility of using the classifier in actual microwave communications lines. Figures 3; references: 5 Russian.
[208-6508]

UDC: 621.396.019.4

EFFECTIVENESS OF PARALLEL TRANSMISSION OF DISCRETE SIGNALS WITH FREQUENCY ADAPTATION

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received 13 Nov 82) pp 58-61

GUT, R. E., MINEVICH, M. L.

[Abstract] An estimate is presented of the effectiveness of frequency adaptation in modems using several frequency channels for parallel transmission of signals. As an example, the values of effectiveness are calculated for the case of Rayleigh fading of signals, normally fluctuating noise and optimal noncoherent reception of binary orthogonal signals. Figures 4; references 7: 4 Russian, 3 Western (2 in translation).
[208-6508]

UDC: 681.385

DESIGN PRINCIPLES OF COHERENT OPTICAL VIDEO PREPROCESSORS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 25, No 11, Nov 82 (manuscript received 30 Jun 82) pp 38-47

OCHIN, Ye. F., Leningrad Institute of Precision Mechanics and Optics

[Abstract] In a visual system the image preprocessor, called the video preprocessor, performs operations not associated with analyzing the structure of the image, such as altering the contrast, isolating outlines, skeletizing, constructing isophots and spatial-frequency filtering. The functional capabilities of coherent optical processors which perform the functions of image preprocessors in artificial visual systems are discussed. The structure of such a system includes as an imaging system a lens with variable focal length installed on a rotating platform enabling the required number of angular degrees of freedom. The imaging system's control unit alters the angular orientation of the visual system, the lens' focal length and the aperture on the basis of data received from the image processor. Topics discussed include a coherent Fourier processor; a spatial-frequency filtering processor; synthesis of a spatial-frequency filter by methods of digital, static and dynamic holography; a coherent cell logic processor; and the set of operations of a cell logic processor. The structure of a spatial-frequency filtering processor is represented as a succession of two Fourier processors, whereby the outlet plane of the first Fourier processor and the inlet plane of the second coincide in the so-called Fourier plane, in which is installed a spatial amplitude-phase light modulator whose modulation function agrees with the Fourier transform of one of the convoluted images. The spatial amplitude-phase modulator is in the form of a Fourier hologram or spatial-frequency filter. Digital Fourier holograms are designed and produced by means of digital computers. In terms of their use in optical devices, digital holograms are analog modulators quantized

in space. The most important problems in the creation of coherent optical processors are the input in real time of images to be processed and on-line adjustment of the spatial-frequency filter, and both of these problems can be solved by means of optically controlled space-time light modulators or transparencies which are designed for forming and converting optical images. Especially promising materials for spatial-frequency filters are nematic liquid crystals which are distinguished by an exceptional variety of electro-optical effects. A description is given of a coherent processor which implements the convolution operation in real time. Two transparencies with separate transmission functions are placed in the inlet plane of the first Fourier lens and an optically controlled transparency which registers the intensity of the sum of the Fourier transforms of the transparencies is placed in the Fourier plane. The Fourier holograms thus formed is reflected by a collimated beam and a second Fourier processor, by means of a Fourier lens, performs an inverse Fourier transform of the reflected image. One of the fragments of the image in the outlet plane of the second Fourier processor represents convolution of the transmission functions of the two transparencies. The liquid-crystal optically controlled transparencies discussed have resolution of 350 lines/mm and with 30-V supply voltage it is possible to operate at a frequency of about 1000 frame/s. Sensitivity of 10^{-9} J/cm^2 has been reached. The main disadvantage of coherent optical systems is the appearance of speckle structures on images, caused by the roughness of surfaces of the elements of optical systems. Attempts are now being made to create partially coherent optical processors for primary processing of images. Figures 6; references 21: 18 Russian, 3 Western (1 in translation). [122-8831]

AUTOMATIC AND REMOTE CONTROL OF LOW POWER RELAYS

Moscow VESTNIK SVYAZI in Russian No 1, Jan 83 pp 31-32

VOLOSHIN, L. Ya., chief, Republic Television Metrological Laboratory, Regional River Transport Administration, UkSSR Ministry of Communications, KOZUBENKO, Yu. V., KABANOV, V. A., senio engineers, and RASTABAROV, Yu. G., division chief

[Abstract] The republic Production Television-Metrology Laboratory, Regional River Transport Administration, UkSSR Ministry of Communications, has developed a new automation system based on modern elements, allowing a great increase in the reliability of the entire system, facilitating the performance of repair and preventive maintenance opeations. The system allows television relay stations to be operated unattended. A block diagram of the automatic system is presented and explained. Each subsystem in the radio relay station is independently controlled. The operation of each circuit board in the control system is briefly described. The automatic control system also monitors the output signals of the relay station. The new automatic control system is based on modern transistors and microcircuits. It has been installed in an operating relay station and is presently undergoing testing.
[206-6508]

UDC: 621.322.65

METHOD OF PLANNING DIGITAL INJECTION ELEMENT DEVICES

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 2, Mar-Apr 83 (manuscript received 2 Feb 82) pp 176-178

SAMOYLOV, L. K., ROGOZOV, Yu. I. and GLOBA, A. V., Taganrog Radio Engineering Institute

[Abstract] A method is developed for planning injection integrated circuits for the manufacture of logic elements. As an example, an exclusive OR circuit for three input variables is designed. A schematic diagram of a one-bit combination adder with an output inverter planned by the method suggested is presented. The device uses six n-p-n transistors and six reinjecting p-areas. Twelve n-p-n transistors are required to achieve the operation of binary addition by previous methods. The method can thus achieve devices with greater compactness by reducing the number of transistors used, decreasing connecting path lengths and reducing the number of contacts. Power consumption is also reduced. Figures 3; references 5: 3 Russian, 2 Western in translation. [213-6508]

UDC: 535.345.67(088.8)

INTERFERENCE LIGHT FILTER WITH SHAPED BACKING

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 25, No 11, Nov 82 (manuscript received 23 Mar 82) pp 66-70

MATYUNIN, S. A., Kuybyshev Aviation Institute

[Abstract] It is shown that it is possible to create an interference light filter with a specific filtering characteristic by shaping its backing. A set of equations from which it is possible to determine the shape of the backing is given, by solving the problems of a plane-parallel light beam's striking an element of the surface of an interference filter of specific length at a specific angle to its surface with the backing shaped. It is assumed that the backing is shaped along a single coordinate. A formula is given for the transmission of the entire surface of the interference filter. Graphs are presented, of the

backing shape function, F(x), and of the spectral filtering function of the interference filter, along with graphs of the spectral filtering characteristics of a number of interference filters and backing shape graphs corresponding to them. It was assumed that the transmission bandwidth and the transmission maximum of the interference filter do not change with a change in angle of incidence of the beam onto the filter's surface. With a maximum angle of incidence of the beam onto the filter of 50 degrees, the spectral filtering characteristic for a shaped interference filter lies in the range of (0.65 to 1) λ_0, where λ_0 is the wavelength of the transmission maximum of a basic plane interference filter. Under these conditions the shape of the filter's backing is determined from a linear integral equation. The shaped backing can be created by molding the glass backing under pressure followed by polishing of its surface. It is possible to create interference filters with an adjustable spectral filtering characteristic by using a flexible shaped backing made, for example, out of mica. The paper was recommended by the Department (Kafedra) of Radio Engineering, Kuybyshev Aviation Institute. Figures 3; references: 11 Russian.
[133-8831]

UDC: 621.372.54

ANALYSIS OF UNISTOR-BASED ACTIVE FILTER

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received after completion 13 Sep 82) pp 47-50

NALBANDYAN, V. M.

[Abstract] The simplest active elements which can be used in the manufacture of integrated active filters are unistors and gyristors, which can be used to produce active RC circuits with inductive and oscillating reactance. The greatest difficulty in practical production of such a filter is implementation of a unistor. The simplest method of unistor synthesis is to cut it out of an equivalent low-frequency bipolar transistor by selecting the transistor connection circuit and compensating for parasitic conductances. The circuit diagram of an active unistor filter is presented, using a tunnel diode as a negatron, greatly reducing the power supply voltage and expanding the operating frequency range of the compensating negative impedance. A mockup was built and tested. Figures 5; references 9: 6 Russian, 3 Western in translation.
[208-6508]

UDC: 621.376.33

SYNTHESIS OF FIXED RESISTANCE CIRCUIT CLASS FREQUENCY DETECTORS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received after completion 9 May 82) pp 50-54

LEYKIN, B. D.

[Abstract] Frequency detectors which convert FM to AM or PM are widely used. The major characteristic of a frequency detector is the variation of output voltage as a function of frequency. Synthesis of such a detector is therefore reduced to synthesis of its frequency dependent passive circuits. Equations are presented which can be used as a basis for selection of a frequency detector circuit, assuming sensitivity to be the most important criterion. Examples presented illustrate the possibility of producing frequency detectors with fixed input resistance. Figures 4; references 11: 10 Russian, 1 Western.
[208-6508]

UDC: 621.382.029.6

MICROWAVE SURFACE MAGNETOPLASMA WAVES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 3, Mar 83 (manuscript received 6 Jan 82) pp 544-547

BAYBAKOV, V. I. and KUSTOVICH, Yu. V.

[Abstract] An experiment is described in which microwave surface magnetoplasma waves were observed in indium antimonide. The experiment utilized a microwave surface-wave filter whose transmission band was related in a known manner to the parameters of the semiconductor and properties of the surface magnetoplasma waves. The filter is tuned by a magnetic field and has the properties of a microwave tube. Operation of the filter is based on the use of the specifics of waveguide surface magnetoplasma wave propagation, in that the waves propagate only at an angle close to $\pi/4$ to the direction of magnetization of the semiconductor. The ability of the filter to be tuned by the magnetic field was used to create a tunable high-frequency oscillator. The oscillator operated at 10 to 140 MHz as the magnetic field was changed from 0 to 20 kOe and was used as a frequency output magnetometer. Figures 4; references 4: 3 Russian, 1 Western.
[203-6508]

UDC: 621.382.81.001.2

INTEGRATED CIRCUIT DESIGN ALGORITHMS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received after completion. 8 Sep 82) pp 3-9

YASHIN, A. A.

[Abstract] The design of hybrid and large scale integrated circuits by computer is studied. The requirements for selection of an optimal automated design method are noted. Methods of approximate conformal mapping have been developed, yielding effective solutions with any degree of accuracy. The design process is broken down into stages of mapping the initial area on a half plane, mapping of the area thus obtained on a quasi-conical half plane and mapping of this area on a rectangle or semiinfinite strip with a homogeneous plane-parallel field. Algorithms are suggested for the second step of the process. The algorithms allow automation of the design of a large class of microcircuits of complex configuration. The author thanks G. A. Serebryanikov for assistance in calculation. Figures 3; references: 14 Russian.
[208-6508]

UDC: 621.391

SPECTRAL METHODS OF SPATIAL INFORMATION PROCESSING

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 3, Mar 83 (manuscript received 23 Feb 81) pp 475-478

ALESHCHENKO, O. M., BARAKH, M. Ya., GATKIN, N. G. and GORBAN', I. I.

[Abstract] Spatial processing of oscillations can be implemented in either the time or the spectral areas. In the time area delays of oscillations must be equalized and in the spectral area the complex spectra must be set equal. An equation is derived describing a procedure for spatial processing in the spectral area, which can be reduced to multiplying the spectra of the oscillations times a certain factor and applying a Fourier transform. In many cases spatial processing of signals in the spectral area can be effectively implemented by means of fast algorithms. References 3: 1 Russian, 2 Western.
[203-6508]

UDC: 621.391

PRODUCTION OF RADIO IMAGES IN RECEIVER SYSTEM WITH PARTIAL CHANNELS

Mosow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 3, Mar 83
(manuscript received 4 Aug 81) pp 479-490

CHERNYAK, V. S.

[Abstract] A study is made of a radio image based on a generalized coordinate which may be an angular coordinate, range, radial or tangential velocity or signal path difference to separated antennas. The radio image is defined as the mean signal component of a complex process at the output of a filter. The signal received by a linear equidistant antenna array is analyzed. Restoration of the radio image using discrete readings is studied. In a partial channel system the discrete readings can be processed by means of a Kotel'nikov series in order to restore unambiguously the continuous radio image. The partial channel system performs parallel analysis of the object with respect to the generalized coordinate. Methods for reducing the interval between readings without increasing the number of channels are recommended for those cases when it is not possible to avoid detecting the signals in the partial channels. Figures 5; references 5: 4 Russian, 1 Western.
[203-6508]

UDC: 621.391

COMBINING DEPENDENT CHANNELS FOR DETECTING RANDOM SIGNAL IN NOISE WITH UNKNOWN CORRELATION MATRIX

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 3, Mar 83
(manuscript received 14 Oct 81) pp 501-508

ZAKHAROV, S. I.

[Abstract] The problem of optimal invariant combination of channels for detecting a random gaussian signal with an unknown correlation matrix, on a background of random gaussian noise with an unknown correlation matrix is solved. Equations are obtained which generate the optimal decision rule while maintaining a known false alarm probability. The detection characteristics of the decision rules are computed. Calculations of characteristics were made on a computer by L. F. Kalachev. Figures 2; references 11: 7 Russian, 4 Western.
[203-6508]

UDC: 621.391:001.51

ULTRASTRUCTURE INFORMATION PREREQUISITES

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received 14 Sep 82) pp 26-29

KOGAN, I. M.

[Abstract] If a system is optimal, any variation in its functioning conditions results in deterioration of system quality indices. Consequently, existing systems must have some scattering of subsystem characteristics around the strictly optimal values. Because functional stability is related to the adaptability of a system to variations in functioning conditions, the rate at which the system can change its characteristics is important. The rate is influenced by subsystem structure. A simple and typical model of a multilevel system with operating elements at the bottom level is studied. Results of the study indicate that an ordered system structure is preferable only if its inertia is sufficiently small. As inertia of the structure increases, an ultastructure which consists of disordered interconnections among system elements must be organized in order to provide the necessary speed and flexibility. The significance of the ultrastructure is greater, the greater the inertia of the ordered structure, the higher the requirements for system speed and the more complex the system. System complexity can reach a level which threatens functional stability. Figures 3; references 8: 6 Russian, 2 Western in translation.
[208-6508]

UDC: 621.396.62:621.391.84

DESIGN OF FREQUENCY TRANSPOSITION DEVICE BASED ON PRESELECTOR SIDE CHANNEL ATTENUATION

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received 18 Jun 82) pp 87-90

SARAYEV, S. M.

[Abstract] Synthesis of a frequency transposition device includes determination of the permissible subband width, local oscillator frequencies and intermediate frequency band with a fixed input signal frequency bandwidth, predetermined filter selectivity and permissible combination noise level. Two examples of the problem are presented using the equations derived in the article for its solution. The expressions derived allow assigned selectivity characteristics of preselector filters to be used in order to determine the necessary breakdown of the transposed frequency band into subbands, the boundary frequency of the intermediate frequency band and the frequencies of local oscillators such that the preselectors provide attenuation of combination noise. Figures 2; tables 1; references 7: 5 Russian, 2 Western (1 in translation).

UDC: 621.396.677

ADAPTIVE FILTER PARAMETER TUNING RATE WITH QUASI-HARMONIC INPUT SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 3, Mar 83
(manuscript received 13 Nov 80) pp 469-474

MAL'TSEV, A. A. and POZUMENTOV, I. Ye.

[Abstract] Precise expressions are determined for the time constant for adjustment of the weight coefficients of adaptive transversal filters with their use for modeling an arbitrary system, or compensating for noise. The mechanism of deterioration of the rate of adjustment of the weight coefficients with high input signal power is discussed. The input signal is assumed to be the sum of a harmonic component plus white noise. As an example, the behavior of the weight coefficients of a single channel quadrature autocompensator for narrow band noise is studied. It is found that critical situations arise not only with a certain placement of noise sources in space, but also when one very powerful quasi-sinusoidal noise source must be suppressed. The condition for a decreased weight coefficient adjustment rate is sufficiently high noise power or high feedback loop gain, the more probable, the lower the carrier frequency of the input signal. Figures 4; references 9: 7 Russian, 2 Western.
[203-6508]

UDC: 621.396.677.4

QUASI-OPTIMAL ALGORITHM FOR MEASURING SIGNAL AMPLITUDE AND PHASE AT OUTPUT OF RECEIVING ANTENNA ARRAY ELEMENTS IN HETEROGENEOUS MEDIUM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 3, Mar 83
(manuscript received 9 Sep 81) pp 491-500

MASLOV, A. F. and NESTEROV, K. P.

[Abstract] The purpose of this work is to synthesize a quasi-optimal algorithm for measurement of the amplitude and phase of signals at the outputs of an antenna array element and to compare the phase measurement accuracy thus achieved with the accuracy achieved in ordinary self-focusing antenna array systems. In the statement of the problem used, the task of measurement of amplitudes and phases of signals at the outputs of elements of the array is reduced to the task of filtering coefficients. The algorithm obtained provides good accuracy of phase estimation when space-correlated signals are received. It is shown that optimization of the phase estimation process for fluctuating signals requires an estimate of their amplitudes as well as determination of the weight of the signal of each element in estimating the phases. The authors thank Ya. S. Shifrin for support of the work and valuable commenst. Figures 3; references 8: 5 Russian, 3 Western (1 in translation).
[203-6508]

INCLUDING TRANSMISSION SYSTEMS IN RURAL AUTOMATIC TELEPHONE EXCHANGES

Moscow VESTNIK SVYAZI in Russian No 1, Jan 83 pp 22-24

KOZLOVA, G. P., senior engineer, MELAMUD, E. A., laboratory chief, LONITS
(Leningrad Branch of Scientific Research Institute of Communications)

[Abstract] Use of new high-frequency relay connecting lines (RSL) in order to connect transmission systems in rural automatic telephone exchanges such as the K-100/2000 can reduce costs by a factor of 8 to 10 in comparison with the old inductive connections. However, many operating enterprises continue to order telephone exchanges with the old inductive systems. This article presents additional explanations and recommendations for ordering, connecting and using the new RSL HF systems. Figures 4.
[206-6508]

STATE AND PROSPECTS OF COMPUTER DEVELOPMENT

Leningrad IZVESTIYA VYSSHIKH USHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 25, No 8, Aug 82 pp 3-11

[Article by S. A. Mayorov]

[Text] Electronic computing technology is only entering the era of its maturity. In less than four decades, perfect computers of high productivity and large memory resources were created and there appeared data processing systems without which modern science, production and defense are inconceivable.

Modern EVM [electronic computers] became one of the most important factors determining the pace of the development of science, growth of industrial production and increase of the effectiveness of managing the national economy of the country.

Very much attention is given in the resolutions of the last CPSU Congress to the development of computing equipment and its introduction into various sectors of the national economy. On the initiative of the Soviet government, an agreement was signed in 1969 among CEMA countries on cooperation of socialist countries in the area of general-purpose computing equipment. This initiated the realization of the world's largest projects of the development and introduction of modern computing facilities into the national economy of socialist countries [1]. During the last twelve years, three unified familites of general-purpose computers (YeS EVM ON) were developed. The realization of the project became one of clear examples of the potentialities of the complex socialist economic, scientific and technical integration. Cooperation in this area is steadily expanding and at the present time it includes not only YeS EVM, but also, since 1974, a family of small computers (SM EVM) and, since 1978, automated design systems (SAPR), applied program software and standard automatic control systems for various sectors of industrial and nonindustrial spheres of the national economy, integrated maintenance of computing equipment, i.e., the majority of problems connected with the development, manufacturing and introduction of computers. In the ninteen seventies, Cuba and the National Republic of Romania joined the six CEMA countries.

The results of the cooperation of socialist countries led to the fact that the growth of industrial production and national income of the CEMA countries is progressing faster than in the countries participating in the common market and

in the world capitalist system. Just in ten years (1969-1979), industrial production in CEMA countries increased by a factor of 1.85 [1]. This was achieved through harmonious combination of national and international interests of many thousands of people purposefully working according to a single plan of technical policy in the area of computer technique.

The long-term intergovernmental agreement contains the following commitments of the countries:

-- ensuring high-quality and reliability of computing equipment;

-- engineering solutions at a level of the best models in the world;

-- availability of the necessary programs, conditions for high-quality technical maintenance, and others.

Present State of Electronic Computers. In our country, all basic types of computing machines are series-produced. Let us arbitrarily divide all the variety of the manufactured electronic computers into three large classes: 1. General-purpose computers. 2. Problem-oriented computers (minicomputers) (SM EVM), microcomputers (YeS MPN), EKVM [keyboard electronic computers]). 3. Specialized computers.

Let us examine the present state and special characteristics of individual classes of machines [2-4].

1. General-Purpose Electronic Computers. Machines of this class are intended for use in computing and information and data processing centers, in administrations of the sectors of the national economy and transportation. EVM ON is used for scientific and engineering computations, solving economic problems, processing of textual information, etc.

In a comparatively short time, specialists of the CEMA countries developed the Unified Electronic Computer System of the CEMA countries which includes electronic computers of various productivity with total program and information compatibility, single design and technological structural principles and a wide set of peripheral devices. The presence of a large list of peripheral devices and the standard method of their connection make it possible to create computing systems of various configurations. After the first project, the project YeS EVM-2 (series 2) was developed. Comparative characteristics of electronic computers manufactured according to the project of the unified system of series I and II are given in Table 1. At the present time, CEMA countries are producing seventeen models of EVM ON and more than 140 items of external devices and are developing the third series of YeS EVM-3 machines, which will be discussed in more detail later.

2. Problem-Oriented Electronic Computers. In controlling real objects such as, for example, technological and power units, including those with the use of robots, as well as in performing such operations as data recording, accumulation and processing, it is necessary to perform relatively simple algorithms operating with magnitudes whose range of values and precision are relatively small. If the functional and structural organization of electronic computers is oriented

Table 1

(1) Модели ЕС ЭВМ	(2) Производительность, тыс. операц./с		(3) Максимальный объем, Кбайт		(4) Мультиплексные каналы			(7) Селекторные каналы			(8) Дополнительные средства
					(5) количество		(6) скорость Кбайт/с	(5) количество		(6) скорость Кбайт/с	
	I	II	I	II	I	II		I	II		
(9) ЕС — 1010	3,0		64		1		16				
(10) (ВНР) ЕС — 1012	6,0		128		1		20				
(10) (ВНР) ЕС — 1015		12—16		160		1	20		1		ВП (12)
(10) (ВНР) ЕС — 1020	10—20		256		1		16	2		300	
(11) (СССР, НРБ) ЕС — 1021	20		564		1		35	1		250	
(13) (ЧССР) ЕС — 1022	80—90		512		1		80	2		500	
(14) (СССР) ЕС — 1025		60		2,6		1	24		1	800	ВП (12)
(13) (ЧССР) ЕС — 1030	60		512		1		40	3		800	
(15) (СССР, ПНР) ЕС — 1032	200		512		1		40	3		400	
(16) (ПНР) ЕС — 1033	200		512		1		70	3		800	
(14) (СССР) ЕС — 1035		140		512		1	30		4	800	ВП, (12) БМР (18)
(11) (СССР, НРБ) ЕС — 1040	400		1024		1		50	6		1250	
(17) (ГДР) ЕС — 1045		500		3072		1	40		5	1300	ВП, (12) БМР (18)
(15) (СССР, ПНР) (14) ЕС — 1050	500		1024		1		110	6		1300	
(СССР) ЕС — 1055		600		2048		2	40		4	1500	ВП, (12) БМР (18)
(17) (ГДР) ЕС — 1060		1300		8192		2	110		6	1500	ВП, (12) БМР (18)
(14) (СССР) ЕС — 1065		4500		16324		2	200		11	1500	ВП, (12) БМР (18)
(14) (СССР)											

Additional equipment: VP -- virtual memory; BMR -- multiplex mode unit.

Key: 1. YeS EVM model
2. Capacity, thousand operations/sec
3. Maximum volume, Kbyte
4. Multiplex channels
5. Number
6. Speed Kbyte/sec
7. Selector channels
8. Additional equipment
9. Yes
10. (Hungarian Peoples Republic)
11. (USSR, People's Republic of Bulgaria)
12. VP [virtual memory]
13. (Czechoslovakian Socialist Republic)
14. (USSR)
15. (USSR, Polish People's Republic)
16. Polish People's Republic
17. (German Democratic Republic)
18. BMR [multiplex mode unit]

toward this type of application (algorithm), it is possible to create relatively inexpensive computers well adapted for mass application in the sphere of control and data recording and processing. Electronic computers oriented toward solving a limited group of problems are usually called problem-oriented electronic computers.

The class of problem-oriented electronic computers can be divided into three subclasses: minicomputers, microcomputers and EKVM [keyboard electronic computers].

Minicomputers (SM EVM). Until the beginning of the ninteen seventies, there were approximately 400 different models of minicomputers manufactured in the world, including more than 30 models in the CEMA countries. Brief characteristics of some models of minicomputers are shown in Table 2.

Table 2

(1) Модель	(2) Среднее быстродействие, тыс. операц./с	(3) Емкость оперативной памяти, Кслов
M 4000	128	8—128
M 6000	67	16—64
M 7000	133	16—128
CM 1	200	16—32
CM 2	200	8—28
CM 3	400	32—128
CM 4	800	32—124

Key: 1. Model
2. Average speed, thousand operations/sec
3. Main memory, Kwords

In 1974, the CEMA countries, as well as Cuba and Romania joined their efforts in the area of the development and production of minicomputers. The first-stage project (1975-1978) provided for the development of a functionally complete set of technical equipment for assembling various automation systems.

By the end of 1979, they developed a basic series of processors of four types of various capacities (SM1, SM2, SM3, SM4), internal memory using semiconductor and ferrite cores, information tanks, a large set of input-output devices, mapping devices, object communication devices, and others. At the present time, the second series of SM EVM is being developed on the principle of compatibility with earlier models which will make it possible to use the accumulated stock of programs.

Microcomputers are computing machines created on the basis of the technology of large-scale integrated circuits and are intended, chiefly, for their incorporation into the equipment of systems as elements providing logical and arithmetical data processing. The microcomputer is a new mass class of machines which are distinguished by low consumption of materials, low power consumption, high reliability and low cost. The arrangement of all attributes of a universal automatic device on one plate, such as a memory of a considerable volume, sufficiently complicated control circuit, data processing devices and means of external communication, ensured a wide range of applications of microcomputers in industry,

communications and transportation as well as for preliminary processing of measurement results, control of individual processes in a system, control of display systems and others.

Incorporation of microcomputers changes the nature of equipment, increases its productivity, creates a basis for the automation of shops and sections, and changes the role of the designer and the technologist in developing new equipment. The methods of designing systems on the basis of microprocessor sets are radically different from traditional methods of logical designing of integrated circuits. The development of the software also has its special characteristics.

To date, more than 20 variants of microprocessor sets have been developed in our country and three families of microprocessors have been created on their basis.

It became necessary to develop a unified system of microprocessor complexes (YeS MPK) distinguished by their speed of operation and the technology of their manufacturing.

EKVM are intended for performing operations in the process of solving problems. They are usually used as auxiliary means in the process of solving problems with direct participation of man.

3. Specialized electronic computers are intended for the realization of one algorithm. The areas of applications of this class of machines are as follows: computation of correlation and spectral functions of random processes, realization of Fourier transformations, etc.

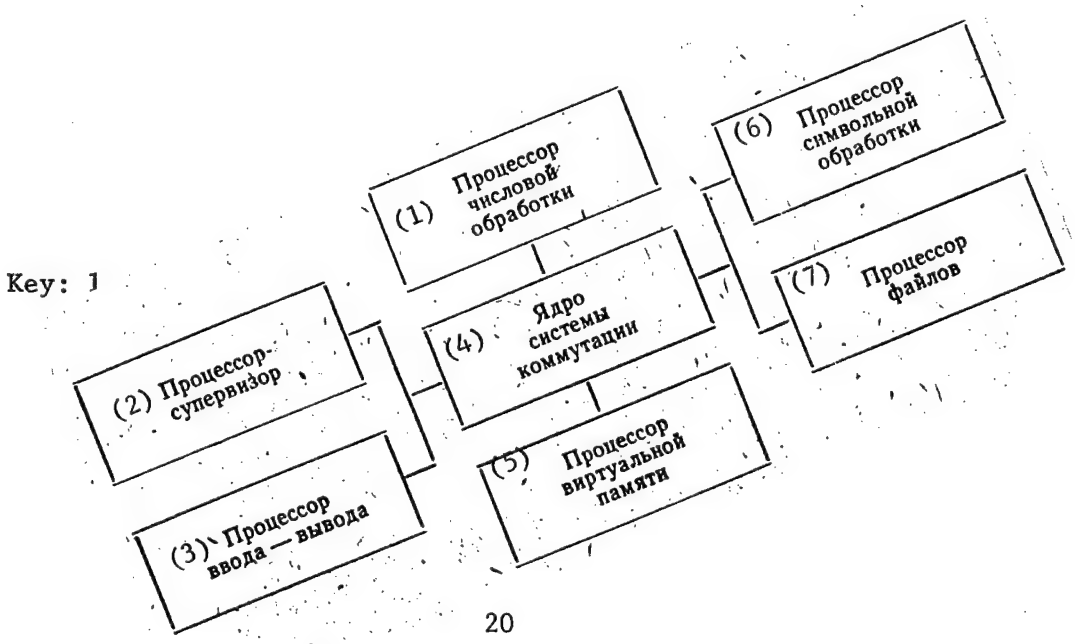
Tendendies in the Development of Electronic Computers. The scientific and technical revolution requires the creation of more productive processing systems, more perfect methods of programming and qualitatively new methods of data input, storage and retrieval.

The process of computer improvement is, basically, evolutionary in nature: computer characteristics improve gradually every year; more and more powerful data storage and processing systems are being created on the basis of electronic computers and the procedures of problem preparation for machine processing are simplified. However, the degree of difference between the needs in data processing and the potentialities of modern electronic computers is so great that it is necessary to provide electronic computers and data processing systems with qualitatively new properties. It is impossible to foresee the discoveries which will radically affect the organization of electronic computers and data processing systems, and it is also impossible to give an exact picture of the future of computer engineering. But it has begun today, and we have the right to visualize it at least from the positions of the hopes and aspirations of today. Ideally, it would be very desirable if man would indicate the problems to be solved to the computer, and the computer itself, or with a minimal human help, would find the methods of solving these problems. However, so far the real potentialities of electronic computers are such that the preparation of problems for solving in a machine -- algorithmization and programming -- is an extremely complicated and labor-consuming process. The functions which electronic computers are required to realize for solving a problem are thousands, millions, and sometimes billions

of times more complicated than those functions which modern computing machines already perform. It is this that complicates the problem of programming, compelling us, before solving a problem, to write a program for the machine consisting of many and many thousands of instructions. Even the most modern electronic computers perform operations prescribed by programs almost without controlling real situations. For example, if names of members of a computing center happen to be at the place planned in the computer memory for storing numbers, the computer will calculate the sum of names "without realizing" the senselessness of this procedure.

Consequently, specialists on computing techniques are faced with many large and very complicated problems. Let us examine some of them.

It follows from the analysis of the development of modern electronic computers, i.e., computers of the third generation, that further development of computers will proceed in the direction of their specialization in the areas of their application and integration of processing facilities in one system, i.e., computer systems will have to consist of a number of devices (processors) specialized in their functions which are united into single multiprocessor and multimachine systems. Thus, effective organization of computer systems is: inhomogeneous computer systems (VS) and networks in which functional potentialities are distributed among the devices of the system. One of the possible variants of such VS organization is shown the figure. Creation of such systems was intiated by the development of electronic computers of the third generation: IBM 360, 370, YeS EVM-2 (series 2), IBM-303 kh. The same tendency is seen in the latest designs of EVM-SDS of series 6000, 7000; EVM Simbol and YeS EVM-3 (series 3).



Key: 1

From the large number of the most important problems mentioned above we shall isolate two problems which have to be solved first:

1. Increasing computer productivity and expansion of memory. This will make it possible to lower the costs of data processing and to solve complex large-scale problems which have to be solved next.

2. The development of electronic computers with new qualities which will make it possible to simplify the process of programming and achieve that people would perform only general direction of the work of electronic computers without the presently existing detailed instructions (programs). It is also necessary to make electronic computers able to control the correctness of their actions, comparing them with the real state of affairs.

There have been many proposals for solving these problems. The future will show their resultativeness. Let us dwell briefly on individual approaches to further improvement of electronic computers in order to stress again that the computer of the future is not a fantasy but an achieveable reality.

Tendencies in the Development of a General-Purpose International System of YeS EVM-3. The basic tendencies of the third family of general-purpose computers are:

-- maintenance of compatibility with earlier families at a level of consumers' programs;

-- ensuring compatibility with foreign machines having IBM-370 architecture;

-- preservation of the architecture of the family at the price of increasing expenditures on microelectronic technology (when changing to a new architecture, it is necessary to take into consideration the necessity of new and considerable expenditures on the development and refinement of applied programs and a long period of revealing unavoidable mistakes and inaccuracies in them);

-- creation of a system of communication with the SM EVM family, which will make it possible to combine the centralization and decentralization methods of data storing and processing, ensuring the most economical method of integrated automation of data processing;

-- increasing the productivity of older models of the family of machines and expansion of functions performed by all models of the family;

-- increasing technical and economic indexes of the family in comparison with the preceding designs and, primarily, reducing the "production-cost" index;

-- wide use of BIS [large-scale integrated circuits] and microprocessor sets in the family models;

-- improvement of studies on integrated technical maintenance and international services [5].

It is planned to accomplish problem orientation of the new family of computers with the aid of specialized processors developed for increasing the productivity of computing systems in solving definite classes of problems. Of course, the developed matrix processors YeS-2345 and 2355 created according to the program of YeS EVM-2 will be used.

It is proposed to create in the new family of YeS EVM-3 special processors for solving the following problem: processing of textual information; interpretation of high-level languages; Fourier transformations and matrix calculations; solution of boundary value problems of the field theory, and others.

It will be promising for the new family of electronic computers to have a multiprocessor structure which will include a processing, a functional and a controlling processors.

Processing processors include matrix processors of high-level languages (ensuring effective translations) and processors ensuring compatibility with preceding models of YeS EVM. Functional processors include input-output processors, telecommunication processors and file processors (optimizing the processing of files).

In addition to the above-mentioned problems, the new family of computers will find applications for the organization of distribution systems and networks for data gathering, storing and processing.

Tendencies in the Development of an International System of Minicomputers (SM EVM). The minicomputer class is the largest class of computers. A number of the tendencies in the development of YeS EVM-3 examined before applies fully to SM EVM, for example, their compatibility with earlier designs in the class SM EVM, introduction of models of specialized processors in their structure, improvement of the technical and economic effectiveness of the models, and improvement of the technical and economic indexes of EVM [6].

The second series of SM EVM is characterized by:

-- development of standard and widely circulated information and controlling-computing systems which most fully satisfy the needs in them with respect to technical and program facilities;

-- the use of new dialogue facilities, means for increasing the reliability of computing systems with a minimal redundancy of equipment, and others;

-- arrangement of local working storage in the peripheral equipment in order to ensure the processing of a number of data without the participation of the central processor;

-- attempts to change minicomputers into a basis for the construction of a number of terminal stations as a part of SM EVM and YeS EVM families;

-- creation of the second series of the necessary program software for all models.

It is planned to create the following models in the program of the second series of SM EVM: SM 1410, SM 1420, SM 1210, SM 1600 and SM 1800 (see Table 3).

Table 3

SM EVM Model	Characteristics
1	2
SM 1410	Constructed on the basis of model SM4. The processor is compatible with EVM "MIR". Program language -- "Analitik-79". Can perform decimal arithmetic operations with a multi-length number. Model is supported by RAFOS [separation of functions of operating system] system.
SM1420	Improved model. Uses the latest integrated circuits in the processor, controllers and main memory OP; has higher operational characteristics; OP volume expanded to 2 Mbytes. Areas of application: distributed control systems for technological processes, multiterminal complexes for various purposes and main processors in data teleprocessing networks. Five program systems are used.
SM1210	Uses operating principles of models SM1 and SM2 (but with better technical characteristics due to the use of microprocessor sets). Main purposes of the model: replacement in all existing systems computation complexes M 6000, M 7000, SM1, SM2 and SM1210 with respect to all main parameters. Areas of application: control of technological processes, processing of geophysical information, automation of technological preparation of production, etc.
SM 1600	Based on model SM 4. Ensures batch processing mode. Uses the principle of separation of functions between universal and specialized processors. SM 1600 processor is compatible with minicomputers M 5000, M 5100. Areas of application: solution of accounting, economic planning and statistical problems, as well as in ASU [automated control systems]. Program software; COBOL, PL/1, OPG, Diams and DOS RVR languages.
SM 1800	Based on a microprocessor set. Manufactured in different versions and can be used as a part of computation complexes with minicomputers and universal computers (in constructing terminal stations for VTsKT [collective-use computer centers] and for data teleprocessing networks).

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10,233
CSO: 1860/207

UDC: 681.3

MICROCOMPUTER FOR AUTOMATING HIGH-PRECISION THERMAL PHYSICS MEASUREMENTS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 25, No 11, Nov 82 (manuscript received 4 Sep 81) pp 87-90

PLATUNOV, A. Ye., SKORUBSKIY, V. I., TRET'YAK, L. N. and EKALO, Yu. V., Leningrad Institute of Precision Mechanics and Optics

[Abstract] Special units for measuring thermophysical quantities, which include an operating mode control system and a system for measuring and recording results are used for the purpose of creating standards for thermophysical quantities and for high-precision determination of the characteristics of materials. Repeated measurements over periods of a few seconds to several hours are often required and it is necessary to adapt to changing conditions. Improvement of measuring accuracy and reduction of the labor intensiveness of attending to this equipment are possible only by using computers. A measuring system employing a calorimeter is discussed, which includes a special-purpose high-speed microcomputer designed from a quantity-produced microprocessing unit. Thermophysical quantities are measured precisely by using V-06M2 and L-04 standard calorimeters. Heat of combustion, heat of solution, heat of chemical reaction and heat capacity are mong the quantities measured. Heat is determined from the equation $Q_r = (Q_\tau / \Delta t_\tau) \Delta t_r$, where Δt_r is the change in temperature as the result of reaction; $Q\tau$ is the characteristic of the reference material; and Δt_τ is the rise in temperature in the calorimeter associated with the heat released, Q_τ. Adaptation to the process being regulated is possible by means of a VRT-2 built-in analog regulator. The use of adaptive digital regulators which adapt automatically with a change in operating conditions is promising. The structure of an automated measuring complex includes a thermophysical unit, information converters, a timer, microcomputer and input/output units. Digital voltmeters of the Shch68000 of F30 type are used in precision measurement channels. From one to three control channels are contained in the system for the purpose of controlling adiabatic membranes and maintaining the temperature under isothermal conditions. The microcomputer receives the measurement results, controls temperature conditions and runs the experiment's program. The timer synchronizes measurements and a set of equipment including a tape puncher, photoelectric reader and printer is used to input the program and initial parameters and to print out results. The microcomputer processes measurements with an accuracy to nine decimal digits and controls the temperature conditions of a calorimeter in real time and also converts information with periodic reading of the voltmeter. The paper was recommended by the Department (Kafedra) of Computing Techniques, Leningrad Institute of Precision Mechanics and Optics. Figures 3; references: 3 Russian.
[133-8831]

UDC 681.5.033.23

CRITERIA FOR PRESELECTION OF INFORMATIVE FEATURES IN PATTERN RECOGNITION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian
Vol 25, No 11, Nov 82 (manuscript received 23 Oct 81) pp 48-52

DREYZIN, V. E. and IVANOV, V. I., Kursk Polytechnical Institute

[Abstract] In solving any problem in pattern recognition, the selection of informative features has a great influence on the effectiveness of the problem's solution. Finding an optimal solution is impaired considerably by the fact that this is the most poorly formalized step of the problem. The primary list of distinctive features is usually determined by the investigator on the basis of experience and intuition, available measuring equipment and a priori information on the problem to be solved. The tendency to make the list too long in order not to leave anything out results in inevitable redundancy and too close intercorrelation of features in the list. Formal criteria are needed for estimating the distinctive features of a specific trait or subgroup of traits. Two-step selection of informative traits is suggested here. At the first step selection must be performed without regard to the classifier to be utilized subsequently, using as a basis only the metric properties of distributions of classes, primarily, sampling properties. This will result in weeding out of poorly informative and closely intercorrelated features. At the second step various methods of constructing classifiers are tested and final selection is made of the subset of features enabling the required effectiveness of the classifier. Only the first step is discussed here. Possible criteria for the informativeness of features are discussed. The criterion for the separability of classes is a quantitative measure of the separation between subsets representing values of the coordinates of sampling realizations of the classes to be separated in an appropriate space of features. The case when there is a total of two classes to be separated is discussed first, and then the results arrived at are generalized for the case of more than two classes. Divergence is used as the measure for separation between two classes and it is found through knowledge of the distribution density of each class. If it can be assumed that the distributions of classes are normal, the characteristics arrived at can be used fully as criteria for the informativeness of individual features and any group of them. However, a more general criterion for informativeness is found which does not require knowledge of the law of distribution of classes and relies only on the basic assumption of the compactness of classes. The criteria arrived at represent a generalization of familiar measures of the separation of classes, i.e., divergence and the Makhalonobis distance, for the case of unknown distributions of classes. Expressions are found for estimating the distinctive features of each trait individually and for finding the optimal subset of traits to be included in a primary list of n traits. The paper was recommended by the Department (Kafedra) of Computing Techniques, Kursk Polytechnical Institute. References 5: 4 Russian, 1 Western in translation.
[133-8831]

UDC: 532.216.2:537.6.029.6

INTERACTION OF SURFACE MAGNETOSTATIC WAVES WITH DELAYED ELECTROMAGNETIC WAVES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 3, Mar 83
(manuscript received 5 Jan 82) pp 538-543

KARMAZIN, S. V., ZIL'BERMAN, P. Ye., NAM, B. P. and Khe, A. S.

[Abstract] The purpose of this work is the detection and experimental study of effects arising during interaction of magnetostatic waves and electromagnetic waves in a structure consisting of a flat "meander" type delay system attached to an iron-yttrium-garnet epitaxial film. The delay system is used to equalize the phase velocities of the two wave types. Very effective resonant interaction of delayed electromagnetic and magnetostatic waves in the IYG film is detected. The interaction yields a number of effects which can allow studies of the characteristics of electrodynamic delay systems, magnetostatic wave propagation parameters as well as the physical specifics of the interaction of two wave processes. Figures 5; references 9: 6 Russian, 3 Western.
[203-6508]

UDC: 539.216.2:537.8

THERMAL RECORDING OF ELECTROMAGNETIC FIELD BY THIN CONDUCTING FILMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 3, Mar 83
(manuscript received 1 Oct 79; after revision 19 Jan 82) pp 548-553

VINOGRADOV, Ye. A., GOLOVANOV, V. I., IRISOVA, N. A. and LATYSHEV, A. B.

[Abstract] A study is made of receivers using thin metal films applied on dielectric substrates in order to receive electromagnetic radiation in the microwave-IR band. The question arises in such cases as to which characteristics of the electromagnetic field are actually measured. This article studies only one aspect of this problem: the relationship of the thermal relief of the film to the initial electromagnetic field. It is assumed that the field is weak enough that the problem can be considered linear. Equations are derived yielding the relationship of thermal relief with electromagnetic field characteristics developing as a result of interaction of the thin conducting film with

the incident wave. Expressions are obtained for the reflection, transmission and absorption factors of the incident wave by the use of an impedance approach. The thermal relief is found to be determined by the tangential component of the excited electric field, and may be similar either to the electric or to the magnetic relief of the incident wave. The authors thank T. S. Mandel'shtam, S. P. Lebedev and D. A. Luk'yanov for taking an active part in the discussion "What we see on a thermo-microwave imager." The authors are grateful to L. A. Vaynshteyn for a detailed discussion of their work. Figures 1; references 8: 4 Russian, 4 Western.
[203-6508]

UDC: 621.391.82:62.501.72

ALGORITHMS FOR OPTIMIZING FREQUENCY BAND ALLOCATION FOR GROUPS OF SIMILAR ELECTRONIC DEVICES BASED ON ELECTROMAGNETIC COMPATIBILITY CONSIDERATIONS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received after completion 17 May 82) pp 44-47

YERMAKOV, A. I. and SOLOV'YEV, V. V.

[Abstract] Minimization of the bandwidths allocated for various uses is a necessary task. The problem of maximizing the number of devices operating in a single frequency band is formulated as a problem in calculation of the electromagnetic compatibility of the devices. The problem can be solved using a YeS-1022 computer in 1 or 2 minutes of machine time for a group of up to 100 radiating devices. Algorithms based on the method of local optimization are suggested. The algorithms were tested by computing the minimum frequency bandwidth required for a group of devices. Figures 2; references 5: 3 Russian, 2 Western (in translation).
[208-6508]

UDC: 658.562:621.396.6

TECHNICAL DIAGNOSIS OF ELECTRONIC AND OTHER DEVICES BASED ON ELECTROMAGNETIC COMPATIBILITY PARAMETERS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received after completion 26 Sep 82) pp 38-41

KNYAZEV, A. D.

[Abstract] Standard concepts of technical diagnosis are based on the assumption that a product is functioning properly if it is performing its job at the moment. However, this is insufficient for electronic device technical diagnosis, as well as for diagnosis of other products which create radio noise. Consequently, there are parameters which do not influence performance of the job of a product

but do influence its ability to work compatibly with other products in systems. A systems approach to the design, production and operation of electronic equipment can only be considered as truly a systems approach if electromagnetic compatibility parameters are determined during routine maintenance, not just during manufacture. Major trends in the diagnosis of products with electromagnetic compatibility parameters include determination of the minimum number of electromagnetic compatibility parameters which must be measured and analysis of the mechanism of development of changes in EMC parameters as a product is used over a period of time. Models of the EMC status of devices must be developed, EMC testing equipment designed and produced, and products must be designed which can be tested in terms of electromagnetic compatibility over their operating lives. This will also require the development of operational and maintenance documentation which considers the EMC properties of products. References 7: 5 Russian, 2 Western (1 in translation).
[208-6508]

CONFERENCE ON PROTECTING COMMUNICATIONS AND TELEMETRY LINKS AGAINST ELECTROMAGNETIC FIELDS

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 1, Jan 83 pp 19-20

YAGUDIN, R. Sh., chief, Reliability Department, Chief Directorate of Signalling and Communications, Ministry of Railroads

[Abstract] A conference on protecting communications and telemetry links against external electromagnetic fields was held in Omsk in late 1982 under the sponsorship of the Central Administration of the Scientific-Technical Society for Rail Transport, the Omsk Institute of Rail Transport Engineers and the West Siberian Railroad. Among the participants were representatives from signalling and communications organizations and transportation-related scientific research institutes. The papers presented included data on the following: 1) Interference from d.c. railroads on overhead communications lines and the use of filters to control it; 2) Interference of power supply lines on communications circuits and improved active protective methods, including a device for reducing zero phase-sequence currents in the transmission lines; 3) Use of twelve-pulse rectifiers in place of the six-pulse devices now in use at traction substations; 4) Influence of d.c. traction networks on 50-Hertz rail circuits; 5) Protective devices for feed-in and distribution of line communications circuits to accomodate main cables, secondary switching and trunk lines, local and station administrative communications circuits; and 6) Influence of pulsed automation and telemetry circuits on communications channels. It was noted that, in spite of the great deal of relevent work being done, there has not been enough development of an experimental base for research purposes, and the implementation of protective measures which have been developed is lagging. It was recommended that: 1) Work be continued on determining the sources of external electromagnetic fields, establishing standards for the output voltage of traction substations in terms of electromagnetic compatibility; 2) Standards be developed for acceptable noise levels induced in communications circuits by newly designed devices; 3) Line communications systems be developed and implemented with devices to protect circuits against harmful and interfering

influences; 4) Research on cable corrosion caused by a.c. power lines be continued, and 5) Systems for status testing of protective devices be checked. Standard computer programs should be used when designing new lines in order to calculate their influence on communications and telemetry links. It was also recommended that existing experience with various devices be extended to other railroads, and that a number of railroads perform operational tests of a high-voltage line protection cutoff device.
[155-6900]

UDC: 621.318.571

ANALYSIS OF ONE CLASS OF MAGNETIC THRESHOLD ELEMENTS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 83 (manuscript received after completion 11 May 82) pp 54-58

GLUZMAN, P. L.

[Abstract] A new class of magnetic threshold elements constructed of basic induction elements is studied. Equations are derived for the amplitude of the output signal, the level of the logic 1 and B(H). Magnetic threshold elements using variable cross section cores are also studied. Figures 3; tables 1; references: 6 Russian.
[208-6508]

UDC: 621.318

CYLINDRICAL MAGNETIC DOMAIN BOUNDARIES

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 2, Mar-Apr 83 (manuscript received 7 Jun 82) pp 123-142

ROZENBLAT, M. A. and YURCHENKO, S. Ye., Institute of Control Problems

[Abstract] Cylindrical magnetic domains or magnetic bubbles represent a promising technology for nonvolatile random access memory. This article reviews the basic theoretical and experimental results obtained recently in the area of studies of domain boundary structures on the properties of magnetic bubbles. Domain boundary structures and the magnetization and movement properties of bubbles are briefly described. A photograph illustrates the structure of a magnetic bubble memory array (taken from an American sources). The domain boundaries in ferrite-garnet films have a complex internal structure and significantly influence the static and dynamic characteristics of magnetic bubbles. Virtually all the dynamic phenomena observed in ferrite-garnet film magnetic bubbles can now be explained. The saturation rate and its variation as a function of material parameters and bubble size, the mechanism of domain boundary spreading during movement in strong fields have not been satisfactorily explained. The authors call upon physicists to study the development of a

theory of the dynamic behavior of domain boundaries in strong fields, the fine structure of domain boundaries in ferrite-garnet films, the dynamic behavior of domain boundaries, the influence of bubble carrier material characteristics on the inertial ballistic effect and methods of nongradient movement of bubbles. Figures 9; references 134: 41 Russian, 93 Western.
[213-6508]

UDC: 621.372.832.029.6

ORIENTED COUPLERS FOR THREE-DIMENSIONAL MICROWAVE INTEGRATED STRUCTURES

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 2, Mar-Apr 83
(manuscript received 30 Jun 82) pp 163-170

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[Abstract] The transition from hybrid integrated circuits to monolithic circuits is being delayed by the shortage of the necessary elements, particularly active distributed elements. The use of combinations of transmission lines allows a new approach to the planning of microwave circuits, with microwave signals propagating and being processed in three dimensional space. This article analyzes the class of base elements from a three-dimensional integrated circuit element library known as wideband quadrature loop oriented couplers, which is most frequently used in the planning and design of mixers, modulators, amplifiers, power dividers and adders and measurement elements. The frequency characteristics of such devices are experimentally determined. The class of devices in question represents a broad set of basic elements for three-dimensional microwave integrated circuits, significantly expanding the capabilities of the microwave electronic device designer. The authors are grateful to Ya. A. Monosov for helpful comments. Figures 4; references 13: 7 Russian, 6 Western (3 in translation).
[213-6508]

LASER BEAM AT WORK

Moscow EKONOMICHESKAYA GAZETA in Russian No 14, Apr 83 p 2

[Article by Academician Ye. P. Velikhov, vice-president of the USSR Academy of Sciences, director of the program "Creation and Production of Laser Equipment for the National Economy"]

[Text] The development of the laser technique is a convincing confirmation of the determining effect of fundamental scientific discoveries on economy. The laser effect which was predicted, discovered and studied with decisive participation of Soviet scientists in a relatively short time, a little over 20 years, has gone through all stages of development and emerged into the area of multipurpose uses in the national economy.

In industry, it is laser thermal technology, as well as control of technological processes. Lasers can be used effectively in mass chemical production. They are very promising in such areas as biology, environmental protection, construction and irrigation work, communications, computing machinery, printing, recording and processing of images. The potentialities of lasers serve as one of the ways to solve the problem of controlled thermonuclear reaction.

In the 11th Five-Year Plan, a special-purpose integrated scientific and technical program, "Development and Production of Laser Equipment for the National Economy", is being carried out. The work is being done in the following large-scale areas:

-- development and creation of lasers with a radiation power of one kilowatt for technological uses;

-- organization of experimental sections and laboratories at leading enterprises and scientific research institutes of various branches of industry in order to improve and introduce laser technological processes;

-- creation of an industrial base for broad series production of laser and laser technological equipment;

-- development and organization of series production of laser technological devices;

-- assurance of series production of lasers of various types with a power below one kilowatt and laser equipment for various uses in the national economy;

-- labor protection and accident prevention in working with laser radiation.

Participating in this program there are more than 20 ministries and departments and more than 100 organizations-executors. The main organizers of this program are the USSR Academy of Sciences, Minelektrotekhprom [Ministry of the Electrical Equipment Industry] and Minstamkoprom [Ministry of Machine Tool and Tool Building Industry].

Effect of New Technology

The most promising for metal working in machine-building are gas lasers with a power of more than one kilowatt. Radiation of such power is used for cutting, welding, thermal treatment, surface beading and alloying materials. This area of application promisses to become the widest. It is clear even now that laser technology gives more than a double advantage with respect to the main indexes of processes or makes it possible to accomplish fundamentally new operations.

All laser thermal technological processes are characterized by their high productivity and fast recovery of the equipment costs. In spite of a relatively low efficiency (about 10% for the existing laser equipment), laser equipment provides a saving in power consumption due to a better quality of processing.

Comparison of the laser and the argon-arc welding methods, which require about the same amount of energy per unit of weld length, indicates that, as a result of the lengthening of the service life of laser-welded parts, the volume of their production is reduced, in other words, the total expenditures on energy are lowered. Moreover, it should be taken into consideration that the introduction of laser technology gives not only technical and economic, but also social advantages: better working conditions, lower input of manual labor, and healthier conditions.

Laser cutting of material is done at a radiation power density of 10^5-10^7 watts per square centimeter, which is sufficient for melting and evaporation of the substance. The cutting rate is 15-40 meters per minute, and the cut width is from 0.2 to 0.05 millimeters. The wastage of the materials being cut is one-third to one-fifth of that with other methods. It is possible to cut details of complex configurations accurate to several hundredth of a millimeter. Lasers make it possible to cut refractory metals, ceramics, fabrics, plastics, wood, composition materials, or anything else. The process is so fast that the surface does not get heated substantially, the properties of the materials in the zone of cutting practically do not change, and the item does not become deformed due to residual stresses.

It is not necessary to have expensive rapidly wearing cutting instruments made of superhard materials. The high quality of this operation makes it possible to eliminate subsequent finishing of the items. Thus, laser cutting is very effective in the shipbuilding, aviation, electrical and other branches of industry for cutting materials, piercing holes, making indentations and marking components. The saving on cutting amounts to 70%. The cost of equipment is reimbursed in about a year.

Laser welding requires a power density of 10^5-10^6 watts per square centimeter. The thickness of the welded items is about one millimeter per kilowatt of the radiation power of the laser. The welding rate is from 0.3 to 2 meters per minute. The thermal effect zone is so small that there is no danger of any noticeable deformation

of the item being welded. Welded joints are very strong. Moreover, it is possible to combine materials of different kinds. The quality of laser welding is not any inferior than electron-beam welding and, unlike it, does not require any vacuum treatment of the item.

The effectiveness of laser coating with resistive materials is very high. This makes it possible to double or triple the service life of the items under the conditions of high mechanical stresses. Consequently, it is possible to reduce proportionally the production of spare parts. An analogous effect is produced in restoring wornout parts of motors and mechanisms. Laser surfacing is distinguished from other methods of surfacing by its high precision, speed and productivity.

Among other processes of laser treatment, thermal hardening is being used mose widely. At a power density of 10^4-10^5 watts per square centimeter, laser radiation rapidly heats the surface of the item to a temperature close to the melting point. When it cools rapidly, the layer of the material near the surface hardens due to heat removal, and its structure becomes finely dispersed and even amorphous. This increases its hardness considerably and makes it wear-resistant.

The effectiveness of this type of treatment is clearly illustrated by the evaluation of the process of laser thermal hardening of the cylinder head of the engine of the automobile ZIL-130 now being introduced in the association "AvtoZIL". According to calculations, it will save about two million rubles a year. Laser thermal hardening can be used widely in engine-building, machine-tool manufacturing and other branches of industry.

The property of lasers to emit light of a very narrow wavelength range is used in selective technology.

It is known that molecules and atoms in the gaseous state absorb radiation only in narrow spectral intervals. These bands differ for different substances. It is possible to select the wavelength of laser radiation in such a way that it will be sensed by only one kind of molecules which we need. Laser radiation energy is sufficient not only for heating, but also for dissociation of molecules and ionization of atoms.

It is possible to purify substances by removing the remaining dissociated molecules or ionized atoms from the irradiated volume, for example, with an electric field. This method, which makes it possible to accomplish fundamentally new chemical processes, is already being used in laboratory studies.

At the present time, laser enrichment and separation of isotopes, laser purification of substances by the method of selective ionization, laser chemical synthesis, and laser photochemistry are the directions which determine not only the subsequent program of scientific work, but also real prospects of their use at enterprises of the chemical industry. Selective effect of laser radiation on molecules can be used effectively in biology and medicine. At the present time, studies are in progress on laser methods of light therapy.

Road to Industry

The orientation toward integration of science with production set by the 26th Party Congress determined also the approach to the solution of the problem of the

introduction of laser technology. An interdepartmental scientific and technical council was created within the GKNT [State Committee of the USSR Council of Ministers on Science and Technology] and the presidium of the USSR Academy of Sciences. It consists of leading specialists in this area. The work of its eight sections includes the development of technological lasers, instruments and devices using them, and purely industrial problems of their introduction.

The Scientific-Research Center for Technological Lasers of the USSR Academy of Sciences (NITsTLAN) is functioning. Its main problems include not only the development, but also the introduction of laser devices and methods into industry. The center has base laboratories at the automobile plant imeni Likhachev and other machine-building enterprises where scientists and manufacturers jointly determine concrete technological operations performed with the aid of powerful lasers. As practice indicates, this is the most effective way of transmitting scientific studies to industry.

Personnel training occupies a special place. For example, a scientific training center on laser technology of the USSR Academy of Sciences and USSR Minvuz [Ministry of Higher Educational Institutions] was organized on the basis of NITsTLAN and MVTU [Moscow Higher Technical School imeni N. E. Bauman] which conducts instruction in new specialities.

The goals of the special-purpose integrated program set for 1981-1982 were essentially fulfilled. Scientists delivered their studies on lasers with a power from 1-5 kilowatts to the Minelektrotekhprom for organizing series production of technological installations.

These are: laser LOK-2M with a power of 1.2 kilowatt developed in the Institute of Theoretical and Applied Mechanics of the Siberian Branch of the USSR Academy of Sciences, laser "Lantan" with a power of up to 2 kilowatts developed by the Institute of Problems of Mechanics of USSR AS, and a five-kilowatt laser TL5 developed by NITsTLAN, as well as a number of others.

Now, there are experimental sections and laser technology is being introduced at Moscow automobile plants imeni Likhachev and Lenin Komsomol, VAZ [Volga Automobile Plant],Cherepovetskiy Metallurgical Plant, and in the associations Moscow "Salyut", "Labor Banner", Leningrad "Baltiyskiy zavod", "Tulachermet" and a number of others.

Series production and scales of development have been increased in the production of solid-state, gas and semiconductor lasers with a power lesser than one kilowatt, as well as of equipment based on them. Public health services are already using not single experimental specimens, but series-produced laser devices which are used in: surgery -- "Skal'pel'" and "Romashka-1", eye microsurgery -- "Yatagan", in ophthalmology -- "Oka-2", oncology -- "Razbor", therapeutics -- "Yagoda".

The Institute of Spectroscopy of the USSR Academy of Sciences, Institute of Atomic Energy imeni Kurchatov, NITsTLAN and other organizations obtained good results in gasophysical studies, as well as in studies on creating theoretical and experimental principles of selective laser atomic and molecular technology. Studies and designs have been done on the use of lasers in instrument-making, production of monitoring and measuring devices, information processing systems and spectral devices.

In 2 years of work on the special-purpose integrated program, we have become noticeably closer to a wide introduction of laser technology into industry and determined basic organizational problems. But still we are not satisfied with what was achieved. It was possible and necessary to do considerably more. Series production of technological lasers and special equipment for laser processing, unfortunately, have not sufficiently gained in scope.

Problems of Introduction

The transition from the idea to concrete practical application is achieved most rapidly where there is unity of scientific, design and production forces. This is confirmed by the activities of a large number of NPO [scientific and production associations]. In developing new intersectorial technologies originating on the basis of fundamental studies, it is expedient, in our opinion, to form such associations on the basis of leading intersectorial scientific institutions, which, as a rule are institutes of the USSR Academy of Sciences. This is indicated by the experience of the Institute of Electric Welding imeni Ye. O. Paton of the Ukrainian SSR Academy of Sciences and the Siberian Branch of the USSR Academy of Sciences.

The NITsTLAN is intended to be such an intersectorial scientific and production base. However, its capacities are not developing at a sufficient pace.

Laser equipment consists of complex systems which have to be produced at plants of different specializations. Appropriate instructions have been given to the executive ministries. However, the work on creating specialized assembling centers, materials and equipment is progressing slowly in the Minkhimprom [Ministry of the Chemical Industry], Minkhimmash [Ministry of the Chemical and Petroleum Machine Building Industry], Minelektrotekhprom [Ministry of the Electrical Equipment Industry] and Gosstandart [State Committee on Standards]. This work has not been started at all in the Minstankoprom [Ministry of Machine Tool and Tool Building Industry] and Minpribor [Ministry of Instrument Making, Automation Equipment and Control Systems]. The problem of supplying optical equipment for series production of laser devices also has not been solved organizationally.

Since the Minelektrotekhprom does not fully satisfy the demand for lasers, industries which use them are beginning to make the necessary equipment themselves. For example, the Minsudprom [Ministry of the Shipbuilding Industry] makes several variants of devices for their own needs.

The intersectorial nature of laser technology, which requires a large input of scientific research, requires also optimal forms of introduction. In order to work out a concrete technological process in laboratory conditions at plants, it is necessary to have a sufficiently profound knowledge in the area of the physics of lasers, methods of measurements and principles of the interaction of laser radiation with materials. This made it necessary to create base laboratories and experimental sections on the introduction of laser technology at leading enterprises of industry and in leading sectorial institutes with direct participation of the organizations of the USSR Academy of Sciences.

The process of laser treatment of materials are, in many respects, universal and uniform for various branches of machine building. Therefore, it is expedient to form

intersectorial regional centers for studies on the applications of laser technology and fulfillment of individual orders for laser processing. In the future, they will be able to develop into specialized enterprises.

Before we only talked about the advantages of lasers in individual technological processes, but now we are talking about acceleration of work on the creation of flexible, easily reorganizable automated industries with their use. Laser, being an extremely highly productive and universal instrument, is used most effectively when there are no idle periods and losses of power during the preparation of operations. A laser installation must consecutively serve several technological stations at once, each of which operates as a part of a particular line. Then the advantages of laser equipment can increase dozens of times. We are talking here about the creation of "integrated" automated and robotized laser technological systems, shops and plants. This is one of the prospects in the development of work on the special-purpose program.

The 11th Five-Year Plan is an important stage in the introduction of laser equipment and the technology into the national economy. Many advantages which they bring have already been used in practice, but it can be said with assurance that the main achievements are still to come.

10,233
CSO: 1860/211

UDC: 621.373.8 : 536.242

USE OF APPROXIMATE ESTIMATES OF INFLUENCE OF HEATING ON OPERATION OF SOLID-STATE LASER IN CHOOSING ITS PARAMETERS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 25, No 11, Nov 82 (manuscript received 17 Mar 82) pp 74-79

ALEKSEYEVA, V. A., BEREZIN, B. G., LUNTER, S. G., POLYAKOV, M. I., SAKHOVSKIY, S. Ye., KHANKOV, S. I. and SHAPOVALOV, V. N., Leningrad

[Abstract] Heating of the active medium can exert a decisive influence on the operation of a solid-state laser to the point of suppression of lasing with high pumping power and especially with natural heat removal. Consequently, the influence of thermal processes must be taken into account, and for this it is necessary to know the relationship between the active medium's lasing properties and the temperature, as well as the temperature field in the active medium. Development of the appropriate calculation methods represents a very complicated problem, but rather approximate estimates of the key characteristics of a laser are sufficient for practical applications. The maximum time of the laser's operation prior to suppression of lasting, τ_p, can be used as the criterion determining the ability of a laser to operate under conditions of intense heating. Formulas for τ_p have been arrived at for lasers satisfying specific conditions which are usually only realized with a certain degree of approximation. On the assumption that thermal deformations of the active element exert a considerably less substantial influence on lasing than does its heating, $\tau_p = (C_2\theta_0/\chi_2 W_n f)/\Omega$, where C_2 is the total heat capacity of the active element; χ_2 is the thermal loss factor, equal to the ratio of the power of heat release in the active element, P_2, to the mean pumping power; P_n; $P_n = W_n f$, where W_n is the pumping energy; f is the radiation pulse repetition rate; $\theta_0 = t_0 - t_c$ is the maximum overheating of the active medium; t_c is the ambient temperature; and Ω is a coefficient taking into account possible radiant heat exchange of the active element with the heated bulb of the pumping lamp; with forced cooling $\Omega = 1$. The value of θ_0 is a function of the pumping energy and the laser's parameters. Equations are obtained which in principle make it possible to estimate the suitability of a laser for operation with a specific repetition rate. If according to estimates $\tau_p \to \infty$, then normal operation of the laser is possible, at least for a certain time interval. If τ_p equals single numbers of seconds, then operation of the laser is impossible at the frequency in question. Two facts create difficulties in calculations, i.e., the need to determine the value of Ω_{min} and the need to make an a priori estimate of the values of a_0 and α for a

specific laser, where a_0 is the coefficient of proportionality between the gain in the active medium in the first pulse and the pumping energy, and represents non-active losses in the resonator. The values of Ω_{min} is usually in the range of approximately 0.15 to 0.5. The problem of determining a_0 and α can be simplified by taking into account the fact that the set of parameters is limited for lasers operating with natural heat release, and it is possible to use experimental data obtained for a fairly large number of designs. In a table, values of a_0 and α are given, which have been determined experimentally for neodymium-doped phosphate glass with various concentrations and various sizes of active elements installed in various types of pumps. Values of a_0 and α were determined by measuring the threshold pumping energy, W_n, for various values of the reflectivity of the resonator's outlet mirror. The data in the table make it possible to estimate the lasing characteristics of a laser and the maximum operating time for neodymium-doped glass with various concentrations of the activator in typical pumping systems. If τ_p is significantly longer than the thermal inertia of the active element, it is possible for the laser to operate for an unlimited time and this attribute makes it possible to choose one laser design over all others. The paper was recommended by the Department (Kafedra) of Thermal Physics, Leningrad Institute of Precision Mechanics and Optics (LITMO). References: 7 Russian. [133-8831]

UDC: 531.715 : 531.717

SPATIALLY INVARIANT CONFIGURATIONS FOR OPTICAL INSTRUMENTS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 25, No 11, Nov 82 (manuscript received 30 Jun 82) pp 58-66

SUKHOPAROV, S. A., Leningrad Institute of Precision Mechanics and Optics

[Abstract] A survey and classification are given of familiar spatially invariant optical systems and instruments, as well as criteria for an proof of their invariance. Spatial invariance of an optical system means invariance of the position of the image or the direction of rays with shifting of optical elements or of the optical system as a whole. Spatial invariance improves the functional reliability of optical instruments. A mathematical theory has been developed for spatially invariant systems making it possible to analyze the invariance of existing systems and to synthesize new ones. Spatial invariance can be absolute, relative and differential. Spatial invariance is described mathematically by means of spatial transfer functions. The criterion for absolute invariance is equality to zero of the spatial transfer function, u. It is known that $u = k(\xi, \zeta, \eta)$, where k is the spatial transfer coefficient and ξ, ζ, and η are coordinates; for lenses $k = 1 - M$, where M is the scale factor, i.e., any magnification. In mirror and prism systems $k = 0$ with some value of parameters; e.g., $k_u = 1 - (-1)^m$, where k_u is the angular spatial transfer coefficient and m is the number of reflections, so that with $m = 2$, $k_u = 0$. The criterion for absolute invariance is equality to zero of the optical element's or optical system's spatial transfer coefficient. The criterion for relative invariance is equality of the spatial transfer coefficients of the system's optical channels. Relative invariance is defined as invariance of the relative position of images in the field of view of the optical instrument or of the relative direction of the beams of rays with a change in the position of elements or of the multichannel optical system as a whole. Differential spatial invariance is defined as equality of the distances between images in various fields of a multichannel optical system or equality of angles between the directions or rays in various channels of the optical system. The criterion for differential spatial invariance is the condition

$\Delta u_{\ell} = \Delta u_{\ell+1} = \Delta u_{\ell+n}$. Examples are discussed, of absolutely invariant, relatively invariant and differentially invariant optical instruments and systems. These include a corner reflector; a lens with a mirror at its focal point; a configuration of invariant opposing parallel collimators used for measuring errors in angles of deviation of pentaprisms; a non-contacting optical rule; a self-setting level; an invariant sighting device; a biaxial collimator; a configuration of parallel invariant collimators; an invariant monocular rangefinder; and an invariant stereoscopic rangefinder. Figures 10; tables 1; references: 5 Russian.
[133-8831]

UDC: 621.382.8

MEASUREMENT OF INTEGRATED CIRCUIT ELEMENT DIMENSIONS BY DIFFRACTION METHOD

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 2, Mar-Apr 83
(manuscript received 23 Jan 82) pp 107-112

VOLKOV, V. V., GERASIMOV, L. L., KAPAYEV, V. V. and LARIONOV, Yu. V.

[Abstract] It is suggested that the details of the profile of an element be determined by assigning the most probable element profile shape in advance, calculating the model diffraction spectrum and comparing it with the experimentally measured diffraction spectra. Adjustment of the parameter being tested in the model is then performed until the spectra match. Sources of systematic error are noted. It is seen that the systematic error is not a peculiarity of this method, but is shared by optical and photoelectric devices for determination of element dimensions. The diffraction method can be used to measure the dimensions of elements on a plate. Because it is based on mathematical processing of the measured signal, no special model elements need be manufactured in order to calibrate the measurement device. Figures 4; references 6: 5 Russian, 1 Western.
[213-6058]

UDC: 535.8:535.241.13

LIQUID CRYSTAL MATRIX SCREEN

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 2, Mar-Apr 83
(manuscript received 10 Dec 81) pp 157-162

TAGER, S. A. and SHOSHIN, V. M.

[Abstract] One version of a liquid crystal flat matrix screen designed to display large volumes of slowly changing information is described. A flicker-free display is achieved by the use of a mixture of cyanobiphenyls and heptylcyanophenylcinnamate with a 3:1 control system, so-called because the ratio between the voltages on selected and semiselected elements is 3:1. The 128x128 screen has a display area of 80x80 mm, row writing time 25 ms, operating life 2000 hours, contrast 7:1-10:1, bias voltage 30 V, erase voltage 120 V. The authors thank P. V. Alomenas, B. M. Bolotin, Ye. I. Kovshov and Z. M. Elashvil for synthesis of a number of components for liquid crystal composition, and S. V. Peterimov for development of a control circuit. Figures 6; references 6: 3 Russian, 3 Western.
[213-6508]

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